

Claims

- [c1] 1. A variable compression ratio connecting rod for an internal combustion engine, comprising:
a large end adapted for attachment to a crankshaft;
a small end adapted for attachment to a piston; and
an adjustable four-bar system extending between and linking said large end and said small end, so as to permit the length of said connecting rod to be adjusted.
- [c2] 2. A connecting rod according to Claim 1, wherein said four-bar system comprises a primary link extending between said large end and said small end, with said primary link being pivotably attached to said large end, and an adjustable toggle link having a first end pivotably attached to said primary link and a second end pivotably attached to an eccentric journaled within said large end, such that the rotational position of said eccentric determines the length of said connecting rod.
- [c3] 3. A connecting rod according to Claim 2, wherein said eccentric is selectively positionable in a plurality of rotational positions.
- [c4] 4. A connecting rod according to Claim 2, wherein the

position of said eccentric is controlled by a latching device mounted within said large end, with said latching device being controllable so as to rotationally lock said eccentric.

[c5] 5. A connecting rod according to Claim 4, wherein said latching device comprises at least one lock pin mounted within said large end, with said at least one lock pin being controllably extendable into registry with at least one aperture formed in said adjustable toggle link, so as to rotationally lock said eccentric.

[c6] 6. A connecting rod according to Claim 4, wherein said latching device comprises a plurality of lock pins mounted within said large end, with said lock pins being controllably extendable into registry with a plurality of apertures formed in said adjustable toggle link, so as to selectively lock said eccentric into one of a plurality of rotational positions, with each of said rotational positions corresponding to a unique compression ratio.

[c7] 7. A connecting rod according to Claim 6, wherein each of said lock pins comprises a double-acting hydraulic plunger having a pin end, with said plunger being housed within a cartridge mounted in the large end of the connecting rod, with the plunger being acted upon by both a spring force and a hydraulic force for extend-

ing the pin, and hydraulic force alone for retracting the pin.

- [c8] 8. A connecting rod according to Claim 7, wherein said plurality of apertures engaged by said lock pins each comprises a generally circular bore having an initial engagement portion with a non-circular configuration extending about and beyond said generally circular bore.
- [c9] 9. A connecting rod according to Claim 4, wherein said latching device is actuated by engine lubricating oil supplied by passages formed in a crankshaft to which said connecting rod is attached.
- [c10] 10. A method for adjusting the length of a variable compression ratio internal combustion engine connecting rod having a small end for attachment to a piston and a large end for attachment to a crankshaft, with a primary link extending between said small end and said large end, with said method comprising the steps of:
determining a desired compression ratio state for the connecting rod;
detecting the contemporaneous compression ratio state of the connecting rod, and
in the event that the detected state is not the desired state, unlocking a latch positioned between said large end and an adjustable toggle link extending between

said primary link and an eccentric journaled to said large end, so as to allow inertia forces acting upon the connecting rod to cause the toggle link to change the rotational position of said eccentric, so as to cause the rotational position of the primary link with respect to the large end to change, thereby changing the effective length of the connecting rod; and
re-locking said latch so as to maintain said connecting rod at the adjusted length.

[c11] 11. A method according to Claim 10, further comprising the step of detecting the contemporaneous compression ratio state of the said connecting rod following an adjustment of the connecting rod length.

[c12] 12. A method according to Claim 11, wherein the contemporaneous compression ratio state of said connecting rod is detected by sensing the proximity of a portion of the connecting rod to a sensor at a predetermined crankshaft position.

[c13] 13. A variable compression ratio connecting rod for an internal combustion engine, comprising:
a large end adapted for attachment to a crankshaft;
a small end adapted for attachment to a piston by a wrist pin; and
an adjustable four-bar system extending between and

linking said large end and said small end, so as to permit the length of said connecting rod to be adjusted, wherein said four-bar system comprises a fixed length primary link extending between said large end and said small end, with said primary link being pivotably attached to said large end, and an adjustable toggle link having a first end pivotably attached to said primary link and a second end pivotably attached to an eccentric journaled within said large end, such that the rotational position of said eccentric and the resulting position of said toggle link determine the rotational position of said primary link with respect to said large end, so as to determine the length of said connecting rod.

[c14] 14. A connecting rod according to Claim 13, wherein said connecting rod is selectively adjustable to a plurality of lengths determined by a plurality of lock pins mounted within said large end, with said lock pins being hydraulically extendable into registry with a plurality of apertures formed in said adjustable toggle link, so as to selectively lock said eccentric into one of a plurality of rotational positions, with each of said rotational positions corresponding to a unique compression ratio.

[c15] 15. A connecting rod according to Claim 13, wherein said toggle link is unitary.

[c16] 16. A connecting rod according to Claim 13, wherein said toggle link is produced by cracking apart a unitary preform.